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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

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| IN RE APPLICATION OF | : |
| MAKOTO YONEYA, ET AL. | : EXAMINER: NGUYEN, HOAN C. |
| SERIAL NO: 10/070,908 | : |
| FILED: JULY 12, 2002 | : GROUP ART UNIT: 2871 |
| FOR: LIQUID CRYSTAL DISPLAY DEVICE | : |

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Responsive to the Notice of Non-Compliant Appeal Brief of June 5, 2007 and further to the Final Office Action of October 20, 2006 and the Advisory Action of May 15, 2007, Applicants request review of the rejections of the above-identified application by the Board of Patent Appeals and Interferences in view of the following Appeal Brief inclusing a Related Proceedings Appendix.

## (I) REAL PARTY IN INTEREST

The real party in interest is Japan Science and Technology Corporation.

## (II) RELATED APPEALS AND INTERFERENCES

None.

## (III) STATUS OF THE CLAIMS

Claims 1-22 are pending in the application. Claims 2, 8-20 and 22 are presently withdrawn from consideration. Claims 1, 3-7 and 21 are rejected claims. The rejection of Claims 1, 3-7 and 21 is appealed.

## (IV) STATUS OF THE AMENDMENTS

The arguments and/or amendment of the submissions of January 22, 2007; July 31, 2006; February 13, 2006; September 16, 2005; July 12, 2005; November 8, 2004; and the Preliminary Amendment submitted on July 12, 2002 were entered and considered. A Pre-Appeal Brief Request for Review submitted on September 16, 2006 was considered.

## (V) SUMMARY OF THE CLAIMED SUBJECT MATTER

Independent Claim 1 is drawn to a liquid crystal display device. The display device includes a pair of substrates at least one of which is transparent. The substrates are identified as SUB1 and SUB2 in Figure 2 of the specification. A nematic liquid crystal layer is present between the pair of substrates. The nematic liquid crystal layer is identified as LCL in Figure 2. The liquid crystal display device includes a group of interdigitated electrodes formed on at least one of the substrates. Figure 2 identifies the electrodes as EL1B and EL2A. An alignment layer is present between the nematic liquid crystal layer and at least one of the substrates (see the layer identified as AL1 in Figure 2). The alignment layer is one that has been subjected to liquid crystal anchoring treatments in more than one direction (see the paragraph bridging pages 5 and 6 of the specification). The pre-tilt angle of the liquid crystal molecules in the anchoring direction with respect to the substrate surface is substantially zero (see the sentence bridging pages 5 and 6, the last paragraph on page 6 and FIG. 1(b)). The

interdigitated electrodes form an electric field component that is substantially parallel to the surfaces of the substrates (see for example page 17, lines 11-17).

## (VI) GROUNDS OF REJECTION

Claims 1, 3-7 and 21 are rejected as anticipated under the meaning 35 U.S.C. § 102(b) over a patent to Kim (U.S. 6,091,471). The Office asserts that Kim discloses all of the limitations of present Claim 1 (see pages 3 and 4 of the October 20, 2006 Office Action). In particular, the Office asserts that liquid crystal displays having an in-plane switching mode inherently have interdigitated electrodes (see page 2 of the Advisory Action of March 15, 2007). The Office asserts that Kim discloses a nematic liquid crystal cell having in-plane switching mode (see page 2 of the Office Action of October 20, 2006). The Office asserts that an alignment layer having a pre-tilt layer of substantially 0° obtained by a rubbing treatment is disclosed in Figure 14 of Kim (see page 2 of the October 20, 2006 Office Action).

## (VII) ARGUMENT

A) The Office's assertion that liquid crystal cells having an in-plane switching mode inherently have interdigitated electrodes is factually not correct and ignores Applicants' factual evidence. The rejection of the present claims as anticipated over Kim is not supportable and should be withdrawn because Kim does not disclose all of the present claims limitations; namely the office has not shown that Kim discloses a device having interdigitated electrodes..

The claimed liquid crystal display must have interdigitated electrodes (see line 4 of Claim 1 of Appendix VIII). One basis for the Office's rejection of the present claims as anticipated is the Office's assertion that liquid crystal cells having an in-plane switching

mode inherently have interdigitated electrodes. Applicants submitted technical publications authored by Clark ("Sub-Microsecond Bistable Electro-Optic Switching in Liquid Crystals"); Patel ("Flexoelectric Electro-Optics of a Cholesteric Liquid Crystal"), and Jaegemalm ("An Electro-Optic Device Based on Field-Controlled Anchoring of a Nematic Liquid Crystal") as evidence that liquid crystal cells having an in-plane switching mode do not inherently have interdigitated electrodes (see attachments of Appendix IX).

On pages 2-3 of the Amendment filed on July 31, 2006 and pages 5-8 of the Amendment filed on January 22, 2007, Applicants pointed out that the liquid crystal display devices of Clark, Patel and Jaegemalm do not have interdigitated electrodes. In particular, the Request for Reconsideration filed on January 22, 2007 gave reasons why Clark discloses a liquid crystal cell having an in-plane switching mode but does not have interdigitated electrodes (see page 7, line 7 to page 8, line 3 of the January 22 Request for Reconsideration). The reason why Jaegemalm discloses a liquid crystal display device having an in-plane switching mode without requiring interdigitated electrodes was argued on page 5, line 24 through page 7, line 22 of the January 22, 2007 Request for Reconsideration. The reason why Patel discloses a liquid crystal display device having an in-plane switching mode and not having interdigitated electrodes was discussed on page 6, line 18 through page 7, line 6 of the January 22, 2007 Request for Reconsideration.

The Offices responded to Applicants' factual data and arguments by asserting that Tomioka (U.S. 6,682,783) discloses a liquid crystal display device having interdigitated electrodes. Applicants point out that Tomioka does not disclose that all liquid crystal display devices having an in-plane switching mode necessarily have interdigitated electrodes. As pointed out by Applicants on page 5, lines 1-20 of the January 22 Request for Reconsideration, at best, Tomioka provides a general statement of the background art but does not disclose that all liquid crystal display devices having an in-plane switching mode

necessarily have interdigitated electrodes. Thus, the evidence contradicts the Office's assertion that liquid crystal display devices having an in-plane switching inherently have interdigitated electrodes

In the Advisory Action of March 15, 2007, the Office responded to Applicants' arguments that liquid crystal display devices having an in-plane switching mode do not inherently have interdigitated electrodes by citing additional portions of Tomioka and further by citing to Held (U.S. 6,177,972) and Broer (U.S. 7,123,319). See page 2 of the Advisory Action of March 15. With respect to the Office's reliance on Tomioka and Held, Applicants point out that the information cited by the Office is insufficient to demonstrate that liquid crystal display devices having an in-plane switching mode inherently, i.e., in all cases, have interdigitated electrodes. At best, Tomioka and Held disclose particular liquid crystal display devices that may, e.g., optionally, have interdigitated electrodes. Tomioka and Held do not disclose that all liquid crystal display devices having an in-plane switching mode have interdigitated electrodes.

With respect to the Office's reliance on Broer, Applicants point out that Broer is not prior art to the present application. The Office's reliance on Broer in support of the rejections is legally not correct. Moreover, the Office stated that interdigitated electrodes are "comb-shaped" but provided no support for this statement (see the first sentence on page 2 of the March 15 Advisory Action).

In a contradictory statement, the Office conceded in the last sentence on page 2 of the March 15 Advisory Action that Clark, Patel and Jaegemalm do not in fact disclose interdigitated electrodes:

> All references, Clark, Patel and Jaegemalm do not disclose the interdigitated electrodes, which inherently generate the electric field parallel to the substatrates as the applicants' invention.

To the extent the Office's rejection can be understood, Applicants submit that the Office's assertion that liquid crystal display devices having an in-plane switching mode inherently have interdigitated electrodes is factually incorrect as evidenced by the Office's own statement in the last sentence of the March 15, 2006 Advisory Action and further in view of Applicants' factual evidence including the technical publications of Clark, Patel and Jaegemalm.

Applicants have provided ample evidence that prior art liquid crystal display devices having an in-plane switching do not have interdigitated electrodes. The rejection of the present claims as anticipated is thus unsupportable and should be withdrawn.

B). The Office's assertion that the prior art relied on by the Office discloses a liquid crystal display device having a layer with a pre-tilt angle of substantially 0° is factually not correct. The rejection of the present claims as anticipated over Kim is not supportable and should be withdrawn at least because Kim does not disclose all of the present claims limitations.

In support of the rejection the Office cited to Figure 14 and/or 4 of Kim (see page 3 of the Office Action of May 18, 2005). Applicants traversed the rejection in the Request for Reconsideration filed on February 13, 2006 (see pages 9-10).

The prior art alignment layer is prepared by a rubbing treatment. On July 12, 2005, Applicants submitted evidence that a rubbing treatment cannot provide a pre-tilt angle of substantially 0°. The purpose of providing this evidence was to traverse the Office's assertion that the Figures of Kim disclose an alignment layer having a pre-tilt angle of substantially 0°. Applicants argued in the Request for Reconsideration filed on July 12, 2005 that the alignment layer of Kim is obtained by treating a layer by rubbing (see page 8, line 4 – page 10, line 22 July 12, 2005 Request for Reconsideration).

Each of the technical attachments submitted in traversal of the rejection, i.e., Geary (*J. Appl. Phys.*, pp. 4100-4108) and Seo (*Jpn. J. Appl. Phys.*, pp. L503-L506) discloses that a rubbing treatment, such as the rubbing treatment used in Kim to align the prior art layer, cannot provide an alignment layer having a pre-tilt angle of substantially zero (see also pages 2, line 7 – page, 4, line 15 of the Pre-Appeal Brief filed on September 16, 2005).

The Office failed to respond to Applicants' arguments in any meaningful way in this regard. Even though the January 22, 2007 Request for Reconsideration pointed out that the Office did not respond to this argument (see page 2 of the January 22, 2007 Request for Reconsideration), the Advisory Action of March 15, 2007 did not respond to Applicants' argument and factual evidence.

Applicants submit that the rejection of the present claims on the grounds that Kim discloses an alignment layer having a pre-tilt angle of substantially 0° is not supportable at least because Applicants submitted evidence showing that a rubbing treatment cannot provide an alignment layer having a pre-tilt angle of substantially 0°. Applicants further submit the rejection is not appropriate in view of the fact that the Office has not substantively considered and/or responded to Applicants' arguments in this regard in any meaningful way.

The January 22, 2007 Request for Reconsideration further argued that Kim does not disclose an alignment layer having pre-tilt angles of substantially 0° as evidenced by Kim's use of one-headed arrows to indicate the direction of alignment. Applicants argued at length in the response filed on July 31, 2006 that the use of a one-headed arrow in the Figures of Kim show that the prior art pre-tilt angle is not substantially 0° (see page 3, line 22 – page 5, line 20 of the July 31, 2006 Amendment). Applicants referenced publications authored by Seo and Lien as evidence showing that a two-headed arrow indicates a pre-tilt angle of substantially 0° but a one-headed arrow does not (see page 4, line 5 from the bottom to page 5, line 6 from the bottom of the July 31 response).

As discussed above for the argument that Kim does not disclose a pre-tilt angle having substantially 0° because a mechanical rubbing treatment cannot provide such a pre-tilt angle, the Office appears to have completely ignored Applicants' arguments that Kim does not disclose the alignment layer of the present claims on the basis that Kim uses a one-headed arrow which necessarily cannot represent a pre-tilt angle of substantially 0°.

In summary, the Office failed to consider and respond to all of Applicants' arguments and evidence submitted in support of patentability. The Office's rejection is based on a factually incorrect assertions regarding the presence of interdigitated electrodes in prior art devices and the pre-tilt angle of certain layers of the prior art devices. The Office's response consistently ignores Applicants' arguments and mischaracterizes the evidence.

The rejections should be withdrawn in view of the Office's factual errors and refusal to consider Applicants' arguments in support of patentability.

Respectfully submitted,

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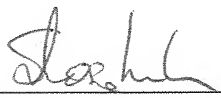

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## VIII. CLAIMS APPENDIX

Claim 1: A liquid crystal display device comprising

a pair of substrates, at least one of which is transparent;

a nematic liquid crystal layer between the pair of substrates;

a group of interdigitated electrodes formed on at least one of the substrates and adapted to apply an electric field to said liquid crystal layer, wherein the electric field has a component substantially parallel to the surfaces of the substrates;

and an alignment layer disposed between the nematic liquid crystal layer and at least one of the substrates,

wherein the alignment layer has been subjected to liquid crystal anchoring treatments in plural directions to form a plurality of liquid crystal in-plane anchoring directions,

the plurality of liquid crystal in-plane anchoring directions of the alignment layer form substantially equal angles relative to one another on the corresponding substrate surface,

a pretilt angle in each of the liquid crystal anchoring directions with respect to the corresponding substrate surface is substantially zero.

Claim 2: A liquid crystal display device comprising

a pair of substrates, at least one of which is transparent;

a liquid crystal layer between the pair of substrates;

a group of electrodes formed on at least one of the substrates and adapted to apply an electric field to the liquid crystal layer, the electric field having component substantially parallel to the surfaces of the substrates; and

an alignment layer disposed between the liquid crystal layer and at least one of the substrates

wherein the alignment layer has been subjected to liquid crystal anchoring treatments in two directions to form two liquid crystal in-plane anchoring directions;

the two liquid crystal in-plane anchoring directions of the alignment layer form an angle of about 90E relative to each other on the corresponding substrate surface;

a pretilt angle in one liquid crystal anchoring direction with respect to the corresponding substrate surface is substantially zero,

a pretilt angle in the other liquid crystal anchoring direction with respect to the corresponding substrate surface is not substantially zero; and

the device is capable of maintaining two stable in-plane alignment states of the liquid crystal layer even after the removal of the applied electric field.

Claim 3: A liquid crystal display device according to claim 1, wherein at least one of the liquid crystal anchoring treatments in plural directions comprises

performing uniform anchoring treatment over an entire target area in each of the in-plane directions.

Claim 4: A liquid crystal display device according to claim 1, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

dividing an entire target area into plural sub-areas corresponding to the plural in-plane directions and

performing anchoring treatment in each of the sub-areas in the corresponding in-plane direction.

Claim 5: A liquid crystal display device according to claim 1, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

irradiating the alignment layer with linearly polarized light which is capable of causing a chemical reaction on the surface of the corresponding substrate.

Claim 6: A liquid crystal display device according to claim 1, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

scanning the alignment layer with a probe which is capable of imparting stress to the surface of the corresponding substrate.

Claim 7: A liquid crystal display device according to claim 1, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

scanning the alignment layer with light which is capable of causing a chemical reaction on the surface of the corresponding substrate.

Claim 8: A liquid crystal display device according to claim 1, wherein the liquid crystal layer comprises a liquid crystal material which comprises chiral molecules.

Claim 9: A liquid crystal display device according to claim 1, wherein the liquid crystal layer comprises a liquid crystal material having a positive or negative dielectric anisotropy depending on the frequency of an applied AC electric field.

Claim 10: A liquid crystal display device according to claim 1, further comprising an additional electrode on each of the substrates wherein the additional electrodes form a pair.

Claim 11: A liquid crystal display device according to claim 1, further comprising a light reflection plate on one of the substrates.

Claim 12: A liquid crystal display device according to claim 2, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

performing uniform anchoring treatment over an entire target area in each of the in-plane directions.

Claim 13: A liquid crystal display device according to claim 2, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

dividing an entire target area into plural sub-areas corresponding to the plural in-plane directions and

performing anchoring treatment in each of the sub-areas in the corresponding in-plane direction.

Claim 14: A liquid crystal display device according to claim 2, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

irradiating the alignment layer with linearly polarized light which is capable of causing a chemical reaction on the surface of the corresponding substrate.

Claim 15: A liquid crystal display device according to claim 2, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

scanning the alignment layer with a probe which is capable of imparting stress to the surface of the corresponding substrate.

Claim 16: A liquid crystal display device according to claim 2, wherein at least one of the liquid crystal anchoring treatments in plural in-plane directions comprises

scanning the alignment layer with light which is capable of causing a chemical reaction on the surface of the corresponding substrate.

Claim 17: A liquid crystal display device according to claim 2, wherein the liquid crystal layer comprises a liquid crystal material which comprises chiral molecules.

Claim 18: A liquid crystal display device according to claim 2, wherein the liquid crystal layer comprises a liquid crystal material having a positive or negative dielectric anisotropy depending on the frequency of an applied AC electric field.

Claim 19: A liquid crystal display device according to claim 2, further comprising an additional electrode on each of the substrates wherein the additional electrodes form a pair.

Claim 20: A liquid crystal display device according to claim 2, further comprising a light reflection plate on one of the substrates.

Claim 21: The liquid crystal display device according to claim 1, wherein the device is capable of maintaining a plurality of stable in-plane alignment states of the liquid crystal layer even after the removal of the applied electric field.

Claim 22: The liquid crystal display device according to claim 2, wherein the in-plane alignment states remain energetically stable even after removal of applied voltage.

## IX. EVIDENCE APPENDIX

The evidence submitted by Applicants, including publications by Patel, Clark, Jaegemalm, Seo, Geary and Lien were previously submitted to the Office during prosecution. Copies of the aforementioned publications are attached.

## X. RELATED PROCEEDINGS EVIDENCE

None.